Acadamh Ríoga na hÉireann
Royal Irish Academy

Archaeology Research Grant Report

Recipient name:	Dr Stephen Davis
Discipline and subject area:	Archaeological Research for World Heritage Sites scheme
Year awarded:	2022
Title of project:	Large-scale GPR survey at the Brú na Bóinne WHS

Summary of findings:

The project aimed to undertake survey at a number of areas across Brú na Bóinne (9 in total) using a multi-sensor ground penetrating radar rig. In some areas this produced spectacularly good results, especially at Dowth Henge where at least one, possibly two tombs were identified along with ditch terminals at the NE entrance and a large number of post-medieval drains which were not identified in previous survey. Elsewhere at Dowth a potential large enclosure was identified outside of the Dowth Hall passage tombs, while other sites previously identified in geomagnetic survey were confirmed and enhanced. In particular this provides crucial depth information regarding the buried archaeology of Brú na Bóinne: in the context of understanding and protecting the archaeological resource it is now clear in some of these locations that the majority of recorded archaeology is c. 50 cm subsurface. In some areas (e.g. Donore) the method was not so effective, likely owing to soil type and conditions. This highlights the necessity of using multiple survey methodologies in such an important archaeological landscape.

Please outline the objectives of the project.

The project aimed to trial high-resolution GPR at a medium to large scale as a comparator to existing geomagnetic datasets. In particular it sought to concentrate on known sites at Dowth (Dowth Henge, areas around the ha-ha, Ballinacrad), Donore (Donore Hill) and Newgrange (Newgrange West 4-post structure) to assess what additional information GPR as an approach could provide over and above the magnetic surveys already undertaken.

Archaeology Research Grant Report

Please describe the methodology used in conducting the research.

The GPR survey was conducted using an 8-channel 400 MHz MALÅ Imaging Radar Array (MIRA) with 8 cm inline and cross-line spacing. This is a multi-channel GPR system containing five transmitting and four receiving antennas with a center frequency of 400 MHz placed in a box pulled by a quadbike. Each survey line delivers 8 individual radar reflection profiles. The 8-channel system covers a 64 cm-wide swath for each driven track, making this instrument a fairly efficient tool for large-scale surveys. Under favourable conditions it is possible to cover a hectare a day with the setup used here. A RTK Gps (Leica GS18i) was used for data positioning. Additionally, a calibrated odometer is attached to the back of the radar box providing exact inline distance information. Data were then exported as GeoTiff images and incorporated into the wider Brú na Bóinne GIS held within UCD School of Archaeology, and anomalies digitized within the GIS environment.

The data were processed using the RSlicer software developed by MALÅ and the applied filters included Subtract DC-Shift, Time Zero Adjustment, AGC Gain, Antenna Ringdown Correction, Bandpass Filter, Migration and Hilbert Transform (envelope). The velocity of the radar wave for the time-to-depth conversion was estimated to 0.1 m/ns using the hyperbola fitting function and the migration test tool of the software. Data were then exported as GeoTiff images.

Please outline the findings of your research and/or milestones achieved.

At Dowth, the area between the ha-ha and the Dowth Hall tombs showed some traces of cairn material and some large pit-like structures, as well as possible early ridge and furrow cultivation. East of the ha-ha one of the previously recorded enclosures is clearly visible, as is the unusual 'box' structure identified in magnetometry. However, some other structures observed in magnetic data are absent while GPR shows a potential large enclosure extending east of the box. At Dowth Henge the external ditch is clearly delimited and marked by a very large stone-linteled drain within it. Within the henge itself a central megalith with passage is clearly evident quite near the surface, with a second potential megalith to the northeast much further down (c. 1 metre) and partially demolished by the banks of the henge. Between these two areas a previously identified 'ring barrow' is also clearly defined in the GPR. At Ballynacrad little obvious archaeology is evident beyond some quite deep-lying ridge and furrow, possibly prehistoric in nature. At Newgrange the post-built enclosure is clearly defined as comprising at least two concentric rings of large posts with a central rectangular setting, possibly of stone. Two survey areas at Donore proved less clear, with some features strongly represented in the magnetic data very hard to see in GPR. Small-scale excavation (under license) demonstrated that the subsoil and bedrock here are very similar, with a high proportion of very soft shale. As such contrast here was quite poor.

Please provide details of the dissemination of the outcomes from this project.

Several posts were made on Twitter immediately post survey, with the RIA clearly tagged and thanked for funding. Some of these results were presented at the EAA conference in Belfast, again featuring RIA logos and acknowledgement. Results are to be published as part of the proceedings of the European Megalithic Studies Group conference 2022 (draft due Jan 2024).

No. of Lectures given/outreach events: 1

Archaeology Research Grant Report

How will you continue to communicate the results of your project and what are your publication plans?

Given the sensitivity of the area and recent purchase by the State of Dowth I have been deliberately lowkey as regards publicity of the results. As stated I have at least one paper to write re these results (meeting with Tony Axelsson and Knut Rassmann to take place in Gothenburg 27-29th Nov), and am also in discussions with Eszter Banffy re publication of the wider Boyne dataset as a collaborative monograph which will include these results.

How did the award enhance your professional development?

It provided a great opportunity to work with an international specialist using another method and will lead to at least one publication. Clearly as a proof of concept the data are excellent and the collaboration worked very well.

What plans (if any) do you have to further your proposal/project?

More survey is clearly needed. It is obvious now that some areas that do not respond to one method need at least a second and perhaps more to be used. In this phase most of the funding was carried by Dr Axelsson's institution (e.g. transport of kit and his own transport).